CLAIMS

What is claimed is:

1. A three-dimensional hydrogel structure micropatterned by a mold from which the hydrogel structure has been separated, the hydrogel structure comprising:

a polymer array of a hydrogel, the polymer array comprising a fluid, wherein the fluid hydrates the polymer array; and

a micropattern defining a surface of the hydrogel, the micropattern corresponding to an inverse micropattern transferred from a mold after separation of the mold from the hydrogel.

2. The three-dimensional hydrogel structure of claim 1, wherein the hydrogel is interfaced with a second hydrogel, the second hydrogel comprising a polymer array, the polymer array comprising a fluid, wherein the fluid hydrates the polymer array.

3. The three-dimensional hydrogel structure of claim 2, wherein the second hydrogel further comprises a micropattern defining a surface of the second hydrogel, the micropattern corresponding to an inverse micropattern transferred from a mold after separation of the mold from the second hydrogel.

4. The three-dimensional hydrogel structure of claim 2, wherein the hydrogel and the second hydrogel are interfaced into a network.

5. The three-dimensional hydrogel structure of claim 3, wherein the hydrogel and the second hydrogel are interfaced into a network.

6. A three-dimensional hydrogel network, the hydrogel network comprising:

a first hydrogel, the first hydrogel comprising a polymer array, the polymer array comprising a fluid, wherein the fluid hydrates the polymer array;

a micropattern defining a surface of the first hydrogel, the micropattern corresponding to an inverse micropattern transferred from a mold after separation of the mold from the first hydrogel; and

a second hydrogel, the second hydrogel comprising a polymer array, the polymer array comprising a fluid, wherein the fluid hydrates the polymer array, and the second hydrogel operably interfaced with the first hydrogel for flow of a liquid.

7. The three-dimensional hydrogel network of claim 6, wherein the second hydrogel further comprises a micropattern defining a surface of the second hydrogel, the micropattern corresponding to an inverse micropattern transferred from a mold after separation of the mold from the second hydrogel.

8. A method for micropatterning a three-dimensional hydrogel structure, the method comprising:

providing a mold, the mold comprising a micropatterned surface;

treating the micropatterned surface of the mold with a release agent;

forming a hydrogel from a precursor, wherein the precursor is in contact with the treated micropatterned surface of the mold while the hydrogel is formed; and

separating the hydrogel from the treated micropatterned surface of the mold such that the mold transfers an inverse of a micropattern to a surface of the hydrogel.

9. The method of claim 8, the method further comprising interfacing the hydrogel with a second hydrogel.

AMENDED CLAIMS

[received by the International Bureau on 02 March 2004 (02.03.2004);
original claims 1-9 replaced by amended claims 1-50 (9 pages)]

CLAIMS

What is claimed is:

1. (Canceled)

2. (Canceled)

3. (Canceled)

4. (Canceled)

5. (Canceled)

6. (Canceled)

7. (Canceled)

8. (Canceled)

9. (Canceled)

10. A three-dimensional hydrogel structure micropatterned by a mold from which the hydrogel structure has been separated, the hydrogel structure comprising:

a polymer array of a hydrogel, the polymer array comprising a fluid that hydrates the polymer array and a second hydrogel comprising a second polymer array hydrated by a second fluid; and

a micropattern defining a surface of at least one hydrogel, the micropattern corresponding to an inverse micropattern transferred from a mold after separation of the mold from the hydrogels.

11. The three-dimensional hydrogel structure of claim 10, wherein the hydrogel comprises a cavity, whereby the cavity is formed by perturbing a portion of the second hydrogel.

12. The three-dimensional hydrogel structure of claim 11, wherein an enzyme perturbs the portion of the second hydrogel by digesting the portion.

13. The three-dimensional hydrogel structure of claim 11, wherein the portion of the second hydrogel is perturbed by a change in temperature.

14. The three-dimensional hydrogel structure of claim 10, wherein the mold substantially comprises silicon materials, poly(dimethylsiloxane) materials, photoresist materials, glass materials, plastic materials, rubber materials, synthetic materials, polymer materials, organic materials or any combination thereof.

15. The three-dimensional hydrogel structure of claim 10, wherein the polymer array further comprises materials selected from the group consisting of biological components, organic components, metallic components, cellular components, synthetic components, intact cells, inorganic components and combinations thereof.

16. The three-dimensional hydrogel structure of claim 11, wherein the cavity is contacted by flow of a liquid.

17. The three-dimensional hydrogel structure of claim 16, wherein the liquid comprises materials that are selected from the group consisting of biological components, organic components, metallic components, cellular components, synthetic components, intact cells, inorganic components and combinations thereof.

18. The three-dimensional hydrogel structure of claim 17, wherein the materials of the liquid adhere to a portion of the cavity.

19. A three-dimensional hydrogel structure micropatterned by a mold from which the hydrogel structure has been separated, the hydrogel structure comprising:

a polymer array of a hydrogel, the polymer array comprising a fluid that hydrates the polymer array, wherein the hydrogel is interfaced with a precursor of a second hydrogel comprising a second polymer array hydrated by a second fluid, whereby the precursor of the second hydrogel diffuses into the hydrogel interfaced therewith to adhere the hydrogels as the second hydrogel forms; and

a micropattern defining a surface of at least one hydrogel, the micropattern corresponding to an inverse micropattern transferred from a mold after separation of the mold from the hydrogels.

20. A three-dimensional hydrogel structure micropatterned by a mold from which the hydrogel structure has been separated, the hydrogel structure comprising:

a polymer array of a hydrogel, the polymer array comprising a fluid that hydrates the polymer array, wherein the hydrogel is interfaced with a second hydrogel comprising a second polymer array hydrated by a second fluid, whereby a destabilizer contacting the hydrogel and the second hydrogel conforms at least one of the hydrogels to adhere the interfaced hydrogels together when a concentration of the destabilizer is reduced; and

a micropattern defining a surface of at least one hydrogel, the micropattern corresponding to an inverse micropattern transferred from a mold after separation of the mold from the hydrogels.

21. The three-dimensional hydrogel structure of claim 20, wherein the destabilizer is selected from the group consisting

of chaotropes, kosmotropes, urea, glucose, glycerol, guanidinium hydrogen chloride and combinations thereof.

22. The three-dimensional hydrogel structure of claim 20, wherein the concentration of the destabilizer is reduced when a stabilizer contacts the hydrogels.

23. The three-dimensional hydrogel structure of claim 22, wherein the destabilizer and the stabilizer are selected from the group consisting of chaotropes, kosmotropes, urea, glucose, glycerol, guanidinium hydrogen chloride and combinations thereof.

24. A three-dimensional hydrogel structure micropatterned by a mold from which the hydrogel structure has been separated, the hydrogel structure comprising:

a polymer array of a hydrogel, the polymer array comprising a fluid that hydrates the polymer array and a second hydrogel comprising a second polymer array hydrated by a second fluid, whereby precursors of the hydrogel and the second hydrogel were combined to interface the hydrogels as at least one hydrogel is formed; and

a micropattern defining a surface of at least one hydrogel, the micropattern corresponding to an inverse micropattern transferred from a mold after separation of the mold from the hydrogels.

25. The three-dimensional hydrogel structure of claim 24, wherein the precursor of the hydrogel or second hydrogel comprises a material selected from the group consisting of biological components, organic components, metallic components, cellular components, synthetic components, intact cells, inorganic components and combinations thereof.

26. The three-dimensional hydrogel structure of claim 19, 20 or 24, wherein the hydrogel and second hydrogel form a network.

27. The three-dimensional hydrogel structure of claim 26, wherein the network is contacted by flow of a liquid.

28. The three-dimensional hydrogel structure of claim 27, wherein the liquid comprises materials that are selected from the group consisting of biological components, organic components, metallic components, cellular components, synthetic components, intact cells, inorganic components and combinations thereof.

29. The three-dimensional hydrogel structure of claim 28, wherein the materials of the liquid adhere to a portion of the network.

30. The three-dimensional hydrogel structure of claim 10, 19, 20 or 24, wherein a portion of at least one hydrogel is interfaced with a substrate.

31. A method for micropatterning a three-dimensional hydrogel structure, the method comprising:

providing a mold, the mold comprising a micropatterned surface;

treating the micropatterned surface of the mold with a release agent;

forming a hydrogel from a precursor, wherein the precursor is in contact with the treated micropatterned surface of the mold while the hydrogel is formed, the hydrogel comprising a fluid that hydrates a polymer array and a second hydrogel comprising a second polymer array hydrated by a second fluid; and

separating the hydrogels from the treated micropatterned surface of the mold such that the mold transfers an inverse of a micropattern to a surface of at least one hydrogel.

32. The method of claim 31, the method further comprising forming a cavity within the hydrogel by perturbing a portion of the second hydrogel.

33. The method of claim 32, wherein an enzyme perturbs the portion of the second hydrogel by digesting the portion.

34. The method of claim 32, wherein the portion of the second hydrogel is perturbed by a change in temperature.

35. The method of claim 31, wherein the polymer array further comprises materials selected from the group consisting of biological components, organic components, metallic components, cellular components, synthetic components, intact cells, inorganic components and combinations thereof.

36. The method of claim 32, the method further comprising flowing a liquid through the cavity.

37. The method of claim 36, wherein the liquid comprises materials that are selected from the group consisting of biological components, organic components, metallic components, cellular components, synthetic components, intact cells, inorganic components and combinations thereof.

38. The method of claim 37, wherein the materials of the liquid adhere to a portion of the cavity.

39. A method for micropatterning a three-dimensional hydrogel structure, the method comprising:

providing a mold, the mold comprising a micropatterned surface;

treating the micropatterned surface of the mold with a release agent;

forming a hydrogel from a precursor, wherein the precursor is in contact with the treated micropatterned surface of the mold while the hydrogel is formed, the hydrogel comprising a fluid that hydrates a polymer array;

interfacing the hydrogel with a precursor for a second hydrogel;

diffusing the precursor for the second hydrogel into the hydrogel interfaced therewith;

forming the second hydrogel to adhere the hydrogels; and

separating the hydrogels from the treated micropatterned surface of the mold such that the mold transfers an inverse of a micropattern to a surface of at least one hydrogel.

40. A method for micropatterning a three-dimensional hydrogel structure, the method comprising:

providing a mold, the mold comprising a micropatterned surface;

treating the micropatterned surface of the mold with a release agent;

forming a hydrogel from a precursor, wherein the precursor is in contact with the treated micropatterned surface of the mold while the hydrogel is formed, the hydrogel comprising a fluid that hydrates a polymer array;

interfacing the hydrogel with a second hydrogel;

conforming at least one of the interfaced hydrogels by contacting the hydrogels with a destabilizer;

reducing a concentration of the destabilizer to adhere the hydrogels together; and

separating the hydrogels from the treated micropatterned surface of the mold such that the mold transfers an inverse of a micropattern to a surface of at least one hydrogel.

41. The method of claim 40, wherein the destabilizer is selected from the group consisting of chaotropes, kosmotropes, urea, glucose, glycerol, guanidinium hydrogen chloride and combinations thereof.

42. The method of claim 40, wherein the concentration of the destabilizer is reduced when a stabilizer contacts the hydrogels.

43. The method of claim 42, wherein the destabilizer and the stabilizer are selected from the group consisting of chaotropes, kosmotropes, urea, glucose, glycerol, guanidinium hydrogen chloride and combinations thereof.

44. A method for micropatterning a three-dimensional hydrogel structure, the method comprising:

providing a mold, the mold comprising a micropatterned surface;

treating the micropatterned surface of the mold with a release agent;

combining a precursor for a hydrogel with a precursor for a second hydrogel;

forming the hydrogels from the precursors, wherein the precursors are in contact with the treated micropatterned surface of the mold while the hydrogels are formed; and

separating the hydrogels from the treated micropatterned surface of the mold such that the mold transfers an inverse of a micropattern to a surface of at least one hydrogel.

45. The method of claim 44, wherein the precursor of the hydrogel or second hydrogel comprises a material selected from the group consisting of biological components, organic components, metallic components, cellular components, synthetic components, intact cells, inorganic components and combinations thereof.

46. The method of claim 39, 40 or 44, wherein the hydrogel and second hydrogel form a network.

47. The method of claim 46, the method further comprising contacting the network with flow of a liquid.

48. The method of claim 47, wherein the liquid comprises materials that are selected from the group consisting of biological components, organic components, metallic components, cellular components, synthetic components, intact cells, inorganic components and combinations thereof.

49. The method of claim 48, wherein the materials of the liquid adhere to a portion of the network.

50. The method of claim 31, 39, 40 or 44, the method further comprising interfacing a portion of at least one hydrogel with a substrate.